Q. (By Mr. Harrell) And give me an example of what you mean by that.

A. The person would be looking for a speech compression decompression algorithm that had the kinds of characteristics that one qualitatively associates with high quality of telephone service. And that would include things such as –

* * * * *

A. Such as intelligibility, speech speaker recognition, and a degree of naturalness – a good degree of naturalness.

Transcript at 501-02.

On the other hand, Dr. Jayant admitted to having written about MOS scoring in the scoring neighborhood of Ericsson's proposed construction:

Q. (By Mr. Harrell) Dr. Jayant, in the early 1980's, did you make statements in your writings about toll quality with reference to MOS?

A. I did, yes.

* * * * *

Q. In those writings, at what MOS score did you peg toll quality?

A. In some of my earlier writings, I was depicting toll quality as something approaching 4.5. In some of my later writings, I was talking about toll quality being at least 4.0. So, in general, I was associating in that time frame in the context I would like to define toll quality with MOS codes in the range of 4.0 to 4.5. [Emphasis added.]

Transcript at 495-496. Dr. Jayant, however, contended that was in the context of wired systems:

Q. Would you please tell the Court what the context was in which you are making those statements about MOS scores in that range for toll quality?

A. Yes. I have two contexts in mind. One was that, in effect, a wired network. And the other was the context of a subclass of speech coders known as waveform coders.

Q. In your opinion, do those measures and, in fact, the use of MOS work in the wireless context in the same way as in the wired context when you made those statements?

A. They do not. They do not straightforwardly extend to the wireless context.

Transcript at 496.

During cross-examination, though, Dr. Jayant conceded that his prior writings may not have been expressly limited to wired systems:

> Q. (By Mr. White) Dr. Jayant, in 1984 you wrote a book -- published a book on speech compression and speech coders. Is that correct?
>
> * * * * *
>
> [Excerpts marked as Ericsson Exhibit 120]
>
> Q. Let's look at some of the contents of your book. And look at first page 10. By the way, Dr. Jayant, this is published in 1984, approximately one year prior to the filing of these system patents, correct?
>
> A. This was in '84, the year before '85.
>
> * * * * *
>
> Q. In the paragraph at the bottom of that paragraph on page 10, near the middle, it says: A score of 5.0 implies perfect quality -- and by the way, this section is talking about the MOS testing, right?
>
> A. Yes, it is.
>
> Q. So the statement that 5.0 implies perfect quality is something that is never attained, correct?
>
> A. That is correct.
>
> Q. In fact, you go on to say that. But then you say a score approaching, approaching 4.5, you didn't say it was 4.5, but it's approaching 4.5, on the other hand, may be regarded as a necessary condition for toll quality. And these are in italics, toll quality.
>
> A. That is correct.
>
> * * * * *
>
> Q. So, if we were talking about commercial telephony, we would have to talk about something approaching a mean score of 4.5 in order to be toll quality, correct?
>
> A. That was the most pristine definition of toll quality that I have seen or used. That is correct.
>
> Q. Would you turn over to the next page, 11, to the first paragraph at the top of the page underneath this Figure 1.5.
>
> A. Yes.
>
> Q. And I want to direct your attention to the last sentence of that paragraph, and I'll quote it for the record: Logarithmic PCM using R equal 8 bits per sample (I=64 KB per second) will be seen to be a toll quality coder in this traditional and rigorous sense. Do you see that?
>
> A. I see that, yes.

> Q. In 1984, when you published this book, 64 kilobits u-law [sic. μ-law] or logarithmic PCM was considered to produce quality of speech quality in the traditional and rigorous sense. Is that correct?
>
> A. In the context of the wired network.
>
> Q. This doesn't talk about a wired network, Dr. Jayant. It talks about a network, communications network?
>
> A. But the only networks we had experience with were wired networks at that point, and that was the context that was assumed in a lot of this book.
>
> Q. Traditional means ordinary and accustomed meaning, doesn't it?
>
> A. Traditional in this case means that. It means time honored.
>
> Q. It means what everybody understood the term to mean at the time.
>
> A. That is correct.

Transcript at 526-30. Later during re-direct, on the other hand, Dr. Jayant was directed to portions of his book said to indicate that he was addressing wired rather than wireless networks. Transcript at 539-41.

That is essentially one side of the issue. On the other side of the issue, Ericsson proffered Dr. Gibson. Dr. Gibson first testified that "toll quality" was a recognized term of art in 1985:

> Q. Let's direct your attention now to the '358 patent and your opinions regarding the meaning of the term "toll quality." Let me have Slide 24, please.
>
> Dr. Gibson, I'm going to have the projector display the preamble portion of Claim 9 of the '358 patent.
>
> A. Okay.
>
> Q. I direct your attention to the term "toll quality" as it appears there.
>
> A. Yes.
>
> Q. Was this a term of art in 1985 that was well understood by someone of ordinary skill in the art?
>
> A. Yes, it was.

Transcript at 779. Dr. Gibson also testified as to his opinion regarding what one of ordinary skill in the art would understand the term to mean in 1985 – predictably, Ericsson's proposed construction:

> Q. What is your opinion that one of ordinary skill in the art would have understood this term to mean in 1985?
>
> A. Toll quality in 1985 was understood by one skilled in the art to mean quality at or equivalent to kilobit mu-law PCM.

> Q. I'm going to display on the screen now Ericsson's proposed claim construction for the term toll quality." Would you explain to the Court what this slide illustrates?
>
> A. As you said, this is Ericsson's claim construction. And it basically says what my opinion is, too, as to what toll quality meant to one skilled in the art at the time of these patents and today.
>
> Q. You indicated that your opinion was that toll quality was a quality equivalent to that provided by 64 Kb mu-law companded PCM transmissions?
>
> A. That's correct.

Transcript at 780.

Dr. Gibson, not surprisingly, further accepted Ericsson's proposed claim construction concerning the specific Mean Opinion Score of "at least 4:"

> Q. What is your opinion regarding the appropriate claim construction for the term "toll quality" as it appears in this proposed – Ericsson's proposed claim construction?
>
> A. Well, whatever test you run, you always tie it to 64 kilobits mu-law PCM. And when you run an MOS test – and I believe this is in my deposition and Dr. Jayant's books and everywhere, really – that the score usually turns out to be for mu-law PCM between 4 and 4.5. And so once you've run that test, you tie it down 4.1, 4.2. And then you compare your testing speech coder that you're testing against that score in those tests.

(Transcript at 781), and, pointed to one of Dr. Jayant's articles:

> Q. Let me direct your attention, Dr. Gibson, to Ericsson Exhibit 703. And I'll have Slide 20, please. This is an article by Dr. Jayant. We have a quote from the IEEE spectrum 1986 article entitled "Coding Speech at Low Bit Rates." Would you explain to the Court what this slide represents?
>
> A. This is an excerpt from that paper, 1986 paper authored by Dr. Jayant. Toward the bottom of the second – first column on the second page, and it says: Subjectively, quality is measured by a mean opinion score obtained by formal tests with human subjects. And MOS of 5 indicates perfect quality. A score of 4 or more represents high quality. And then parenthetically, telephone engineers called this level toll quality in standard waveform coders when they also meet certain transmission specifications.
>
> Q. Do you agree with that?
>
> A. Yes, I do.
>
> Q. Is that consistent with your opinion regarding the ordinary and the custom meaning of the term "toll quality" in 1985?

A. It is consistent with my opinion and experience.

(Transcript at 781-782) and Dr. Jayant's book::

Q. Let me have Slide 21. And I would direct your attention, Dr. Gibson, to InterDigital's Exhibit – I apologize. That's Ericsson's Exhibit 120. What is Exhibit – A. This is excerpts from the book coauthored by Dr. Jayant and Peter Nolls, Digital Coding of Waive Forms.

Q. That's the book that Dr. Jayant was asked some questions about yesterday?

A. Yes.

Q. Dr. Gibson, on page 10 of this book, there is a statement, a score approaching 4.5 on the other hand may be regarded as a necessary condition for toll quality, the quality of commercial telephony.

Do you find that statement? It's near the bottom of page 10?

A. Yes, I see that.

Q. What is your understanding of this statement?

A. Well, I believe this is essentially saying what I've been saying about toll quality and how you measure it and how it's indicated by a mean opinion score and how the toll quality can be indicated by a mean opinion score in the 4 to 4.5 range.

Q. Now, the quote that is shown on the slide is from page 241 of this book. If you would direct your attention over there and comment to the Court. What was it about this statement that you considered important?

A. Well, the main thing that I thought was significant about this statement is that, you know, I was around in 1985 doing speech coding work and it was my experience that this was the common definition of toll quality. And it says all PCM is 64 kilobits per second, is the time order basis for speech coding. And it goes on, really, to explain a little bit why it's used. It was common and it's widely available. And so it was a relatively easy thing to do, to compare to 64 kilobits mu-law PCM.

Q. On page 11, if you go back to the front of this Exhibit, to the last sentence on the paragraph at the top of the page. Would you explain for the Court what you understand this statement to represent.

A. The last sentence of the first paragraph – should I read it?

Q. Yes.

A. Logarithmic's PCM using R equals 8 bits per sample – then parenthetically – I equals 64 kilobits per second – will be seen to be a toll quality coder in this traditional and rigorous sense – and then parenthetically – Chapter 5.

Q. The phrase "traditional and rigorous sense," how do you understand that term?

A. I understand it exactly as I've been talking about it. That was what one understood -- that was skilled in the art understood as toll quality at that time period.

Q. Did you rely upon this particular statement with respect to what was the ordinary and the custom meaning of the term in 1985?

A. Yes, I did, among many others.

(Transcript at 782-784) as being supportive, or at least consistent with, his opinion.

Dr. Gibson also testified that in 1985 he did not draw any distinctions between wired and wireless systems:

SPECIAL MASTER: Dr. Gibson, you heard Dr. Jayant's testimony that when he was making these references he really intended those references to be only for wireline networks. Was that your understanding of his testimony, as well?

A. That's what I heard him say, that's correct. Yes.

SPECIAL MASTER: I take it in 1985 you didn't draw that distinction between these numbers or these tests and wireline versus wireless systems?

A. No, I didn't. I don't believe that that's been done, actually, because the wireless systems are part of the wireline network. And like I explained earlier, you always run your test to determine toll quality against clean speech in an ideal environment, and that's how you set that quality. And that's what has been practiced, actually, since then.

Transcript at 785. Also, Dr. Gibson testified that although there may have been standards in Europe, there were none in the U.S.:

SPECIAL MASTER: Are there any industry standards – like some books are published with various standards that industry has to apply. Are there any standards in the wireless industry dating from 1985 that adopt these standards that you've just been testifying to, for toll quality?

A. Well, I think that -- I'm not sure that any of the wireless standards that we are familiar were set at that time. They were being developed at that time. And they all applied this standard of what they are trying to achieve in toll quality.

SPECIAL MASTER: Were there draft standards being considered by standard setting groups at the time?

A. I believe I tried to tie this down. I can't really recall. But I believe that the European standard was evolving about this time.

SPECIAL MASTER: In the wireless industry?

A. In the wireless industry.

> SPECIAL MASTER: And they were using this same definition that you've just testified to for toll quality?
>
> A. Yes, that's true.
>
> SPECIAL MASTER: But you're not aware of any in the United States?
>
> A. In the 1985 -- in the United States, they were just starting to develop those, too. The Europeans actually beat us to it on this. So, we were just trying to develop at those times, yes.

Transcript at 785-786. Dr. Gibson further testified that he was not aware of any publications that had adopted the standard proposed by Ericsson, at least as of 1985:

> SPECIAL MASTER: Are you aware of any publications that you've seen in connection with your testimony in this case or that you relied on other than Dr. Jayant's work that specifically adopts this standard of toll quality that you've just testified to, to wireless systems?
>
> A. Yes. I mean -- and since then?
>
> SPECIAL MASTER: No. In 1985.
>
> A. Right. In 1985, I believe people, like I said, were shooting for toll quality and trying to achieve toll quality at whatever rate they could squeeze in the wireless channel. But I don't believe there was an established standard at that time, that I know of.
>
> SPECIAL MASTER: Published standard?
>
> A. Published standard, that's correct.

Transcript at 786-87.

On cross-examination, however, Dr. Gibson conceded that a book he had edited entitled *The Mobile Communications Handbook* stated: "When it is comparable to the quality achieved on modern wire-line telephone networks it is called 'toll quality,' " and testified that he was "comfortable" that one skilled in the art could so construe the term –

> Q. In fact, on page 26-9, in your book, you can turn to it, at the top of the page, in referring to toll quality, you say: When it is comparable to the quality achieved on modern wireline telephone networks, correct?
>
> A. Well, I don't say.
>
> Q. The authors say.
>
> A. The authors say. That's correct.
>
> Q. Their language that you adopted as the editor.

A. I didn't censor these chapters. In fact, I encourage people to express their opinion because it's an evolving area.

Q. Do you agree or disagree with that statement in your book?

A. I'm comfortable that one skilled in the art could interpret that, yes, I am.

Transcript at 805-06. *See also* InterDigital's Post-Hearing Brief at 16.

5. Discussion

Based on the current record, therefore, it appears that "toll quality" has both a general connotation and a qualitative measure. Drs. Jayant and Gibson were essentially in agreement that "toll quality" has a general connotation of being similar to the quality that people are accustomed to receiving from wired networks. Dr. Jayant expressed it in terms of "at the end of the day the output speech would be substantially similar to the input analog speech, [and] would therefore give you something that people were used to experiencing in the existing traditional wired telephone network." Transcript at 538. Dr. Gibson, as noted above, conceded that he was "comfortable that one skilled in the art could interpret" "toll quality" as one writer in his book had done, namely "When it is comparable to the quality achieved on modern wire-line telephone networks it is called 'toll quality.'" Transcript at 805-06.

It also appears that the MOS test discussed extensively (and intensively) by the witnesses was an accepted standard for wired networks, and, at least in some instances, was actually used to measure quality in wireless systems. That is not surprising given that the general connotation of "toll quality" was something comparable to that achieved on wired networks. On the other hand, there also appears to be general agreement between Drs. Jayant and Gibson that wireless systems had variables that were not present in wired networks, and that understanding (or appreciating) those variables was necessary in evaluating MOS results. That, of course, is consistent with Dr. Gibson's testimony that although people "were shooting for toll quality and trying to achieve toll quality at whatever rate they could squeeze in the wireless channel," nevertheless, at least as of 1985, there was no established standard. Transcript at 786-87.

Accordingly, as a whole, the evidence is insufficient to establish that InterDigital, by amending the claims to include "toll quality," intended to incorporate any specific standard for "toll quality" into the claims, including the standard proposed by Ericsson. The evidence is also insufficient to establish that it was more likely than not that one of ordinary skill in the art would necessar-

ily have understood "toll quality" in the claims as referring to a specific quantitative standard as opposed to a more general reference to quality approaching that of wired networks.

The file history does not compel a different result. The Examiner Interview Summary Record containing the cryptic comment that "[t]he 'toll quality' feature was discussed as being a potential distinguishing feature," is the sole apparent reference throughout the prosecution history of the '358 patent that "toll quality" had any role in allowance of the claims. And even then, the examiner's written comments do not say that adding "toll quality" would be a distinguishing feature; the examiner only said that "toll quality" was discussed as a potential distinguishing feature. Although Ericsson argues that adding "toll quality" was necessary to overcome a prior art rejection, Ericsson's Post-Hearing Brief at 25 n. 44, that was not a fact established on this record. Indeed, "toll quality," insofar as can be determined from the current record, was not identified as an issue during prosecution prior to the July 1st interview with the examiner, and was not the subject of comment by either the applicant or the PTO after the interview. If, in fact, adding "toll quality" played such a crucial role in obtaining allowance of the claims, one would expect to see some mention of it, somewhere. Here, one finds none. Based on the current record, therefore, it is simply impossible to fairly conclude that the applicant intended, expressly or implicitly, to adopt the specific MOS test that Ericsson posits, or that one of ordinary skill in the art would necessarily understand that "toll quality" in the context of the claims meant the specific MOS test that Ericsson proposes.

There is also a related issue. Ericsson argues that "the use of the term 'toll quality' refers to the quality of voice communication over a network. * * * (toll quality only refers to voice communication, and not, for example, to the quality of transmission of data)." [Emphasis in original.] Ericsson's Post-Hearing Brief at 26. InterDigital construes that as an assertion that claims 9 and 11 are limited to voice communications. InterDigital responds by arguing *inter alia* that the preambles of claims 9 and 11 are non-limiting. That is not, however, an issue that must be decided.

Regardless of whether "toll quality" has been used to refer to a quality of voice communications, the preambles of claims 9 and 11, in referring to "a base station" and "a subscriber station," respectively, "for providing toll quality digital wireless multiple access terrestrial communication * * *," clearly do not limit the claims to a base or subscriber station that is *only* capable of providing "toll quality" access. Moreover, Ericsson points to nothing in the specification or prosecution history that would support limiting these claims to voice communications systems.

6. Recommendation

Accordingly, the special master recommends that the Court conclude that:

> The term "toll quality" in claims 9 and 11 of the '358 patent-in-suit refers to a level of quality comparable to the quality achieved on wired telephone networks. The term "toll quality" does not limit the claims to solely voice communications systems.

B. "switching means"

1. The Claim

Claim 9 of the '358 patent-in-suit calls for:

> switching means for coupling the forward information from the telephone lines as forward signals to the transmitter, and the switching means coupling the reverse signals from the receiver as reverse information to the telephone lines;

The parties agree that this claim element is drafted in means-plus-function format and requires construction under § 112(6). The special master agrees. Thus, the present controversy centers on a search for the "corresponding structure."

2. The Parties' Proposed Constructions

As the following respective positions of the parties illustrate, InterDigital says that the "corresponding structure" consists of switch matrix 25 of PBX 15, while Ericsson adds the codec.

InterDigital's Proposed Construction	Ericsson's Proposed Construction
The base station system also includes a switching mechanism that connects the forward information from the telephone lines to the transmitter. The switching mechanism connects reverse signals from the receiver as reverse information to the telephone lines. The recited function is connecting forward signals from telephone lines to the transmitter and connecting reverse signals from the receiver to telephone lines. The corresponding structure is switch matrix 25 of PBX 15 and equivalents thereof.	The recited function of this "means-plus-function" element is coupling voice information from the telephone lines as compressed signals to be applied to a transmitter in the forward direction, and coupling compressed signals from a receiver as voice information to be applied to telephone lines in the reverse direction. Because the recited function couples forward information as forward signals and reverse signals as reverse information, the recited function must transform and not merely switch. The disclosed structure is a PBX, including A/D converters, each paired with a D/A converter, for converting the analog voice information

InterDigital's Proposed Construction	Ericsson's Proposed Construction
	to/from 64 kbps μ–law companded PCM digital samples, and a switch matrix. Each disclosed converter pair is directly connected to an analog telephone line. The disclosed structure also includes a number of codecs implementing either a RELP or SBC compression algorithm connected to the output of the PBX. The codecs necessarily change 64 kbps μ–law companded PCM digital samples to/from linear PCM digital samples prior to/after implementing either a RELP or SBC compression algorithm on the linear PCM digital samples. As a matter of law, the claim element cannot encompass structure implementing a VSELP or an RPE/LTP compression algorithm.

3. Discussion

Ericsson says that "[c]orrectly defining the function of the switching means-plus-function element is crucial to resolving the dispute over the corresponding disclosed structure." Although that is correct, that is not particularly difficult. The claimed function is "for coupling the forward information from the telephone lines as forward signals to the transmitter, and the switching means coupling the reverse signals from the receiver as reverse information to the telephone lines."

Ericsson says that the specification discloses that analog voice information received over the telephone lines undergoes only two types of changes, namely analog to digital conversion, and compression. When the claim refers to coupling "forward information from the telephone lines" as "forward signals to the transmitter," according to Ericsson, that means that structure beyond PBX 15 is needed to perform the function, *i.e.*, codecs 16 programmed with either RELP or SBC compression algorithms. Ericsson's Post-Hearing Brief at 27-28.

InterDigital says that Ericsson ignores the plain language of the specification which states:

> The system comprises a switching matrix at the base station and set-up means at the subscriber stations with the base station switching matrix being coupled to the telephone lines for coupling first forward information from the telephone lines as first forward signals, and for coupling second reverse signals received

> from the subscriber stations as second reverse information onto the telephone lines.

(Col. 1, lines 47-54) Ericsson responds that this portion of the specification was not part of the application until 1993 "at the earliest" and that a "mere switch" cannot functionally convert voice "information" into "forward signals." Ericsson's Post-Hearing Brief at 29. Ericsson also notes that although InterDigital argued that the specification teaches transmission of uncompressed voice (pointing to columns 47-48) the specification actually teaches compression, and that Dr. Jayant's testimony concerning transmission of uncompressed voice "was only an academic opinion based on a hypothetical possibility." Ericsson's Post-Hearing Brief at 28.

Comparing the specification of the '358 patent to its parents reveals that the above quoted portion from column 1 was, indeed, added at some time. Because of the problems with the prosecution history of the '358 patent that were alluded to above, the record does not clearly indicate when that description was added, or why, and neither of the parties offers any explanation.

Nevertheless, when the claim element is compared to the description in the specification

Claim	Specification
switching means for coupling the forward information from the telephone lines as forward signals to the transmitter, and the switching means coupling the reverse signals from the receiver as reverse information to the telephone lines	The system comprises a switching matrix at the base station and set-up means at the subscriber stations with the base station switching matrix being coupled to the telephone lines for coupling first forward information from the telephone lines as first forward signals, and for coupling second reverse signals received from the subscriber stations as second reverse information onto the telephone lines.

it is clear that the "structure" directly corresponding to the means-plus-function element is the "switching matrix. For present purposes, it also does not matter when or how that description was added. Certainly when and how that description was added may be of significant importance for other reasons, for example validity and what priority date the claim is entitled to. But at this juncture, the sole issue is to ferret out where in the specification the applicant has described a "structure" for performing the claimed function. Here the specification plainly says that the "switching matrix" performs the recited function of "coupling." Thus, the patentees have informed the world that what they intended by the "switching means" element is the switching matrix.

Additionally, Ericsson reads far more into this claim element than the language justifies. The recited function is "coupling." The claim also describes what is coupled to what, but the function remains that of "coupling." The original specification (using the specification of the '705 patent simply for ease of reference) taught that "[c]onnection between the PSTN and the subscriber stations are established and maintained in the private branch exchange (PBX) 15 * * *." (Col. 7, lines 60-62) Although it is readily evident from Fig. 2 that there are a number of other elements (including a wireless link) between the PSTN and the subscriber stations, the patentees were nevertheless broadly, and perhaps loosely, explaining that PBX 15 provided for that connection. The specification also explained that digital voice information from PBX 15 was next processed by a voice compression system, *i.e.*, codecs 16, and that the switch matrix 25 of PBX 15 provided for interconnections between the Telco trunks and codecs 16. (Col. 8, lines 8-10, Col. 9, lines 7-8). The "structure" doing the "coupling" is clearly switch matrix 25.

Ericsson, though, lays great weight on the term "information" versus "signals." Ericsson says that, according to the claim, "forward signals" are "coupled" to the transmitter – implying that those signals are connected to the transmitter. Ericsson's Pre-Hearing Brief at 19. That is not what the claim says, but Ericsson builds on that premise to conclude that "[t]hus, the term 'forward signals' necessarily refers to the compressed digital signals that are transmitted over the RF link from the base station to the transmitter." *Id.* Ericsson is simply wrong.

The specification does not define or equate "forward signals" with compressed digital signals. Indeed, "forward signals" appears to have been a term introduced during the prosecution of the '358 patent or one of its intermediate parent applications. The phrase does not appear in the specifications for the '863, '089 or '705 patents. Those specifications do, however, explain that in assigning channels, one channel is assigned to the base station for transmission and "is called the forward frequency." Another channel, "called the reverse frequency," is assigned to the subscriber stations for transmission. Thus, according to the specification, "the base station transmits on the forward frequency and receives on the reverse frequency. The opposite is true for the subscriber station." ('089 patent, Col. 12, lines 2-10) The terms "forward signals" and "reverse signals" use the same "forward" and "reverse" convention, and, in context, are merely generic references to signals in a forward or reverse direction rather than references to any specific signal. Indeed, that is clear from the preamble to claim 9:

> the system being capable of simultaneous wireless transmission of forward information and reverse information over a radio frequency (RF) link between the telephone lines and the subscriber stations on forward and reverse frequency channels, the forward information from the telephone lines being applied to a transmitter and the transmitter transmitting forward signals over the RF link from the base station system to the subscriber stations, and a receiver receiving reverse signals from the subscriber station over the RF link and the reverse information being applied to the telephone lines

Dr. Levesque additionally testified, without contradiction, that the "forward" and "reverse" terminology was standard in the industry:

> Q. (By Ms. Addison) * * * Just so the record will be clear, would you please tell the Court what forward information means and what reverse information means as used in the telephony – wireless telephony area?
>
> A. In the wireless industry for – I think for a long time now, the term forward has been used to talk about communication from the public network out to the wireless subscribers; and reverse is used to talk about the returning direction from subscribers back toward the public network. That's very standard terminology.
>
> Q. And is it accurate to say it refers to direction of the flow of the signal or the call?
>
> A. Yes. It refers to the direction of flow of communication.

Transcript at 203.

Yet further, the claim does not call for compressing and does not preclude other devices or processes between the "switching means" and the transmitter. Indeed, as discussed above, the specification explains that switching matrix 25 simply provides for the interconnections between the Telco lines and codecs 16.

With respect to the term "information," once again, in the context of the specification and drawings, it is clear that "information" refers to the left side of PBX 15 in Fig. 2, as Dr. Levesque testified. Transcript at 206-07. Even Ericsson appears to agree that "forward information" refers to the inflow from the telephone lines to the PBX and "reverse information" refers to the outflow from the PBX to the telephone lines. *See* Ericsson's Post-Hearing Brief at 27. The term "signals," Dr. Levesque testified, refers to the outflow and inflow on the right-hand side of PBX 15 in Fig. 2. Transcript at 206-207.

Ericsson says that Dr. Levesque's interpretation is "belied by Claim 11, which uses the same two terms, but which does not include a switch as corresponding structure." Ericsson's Post-Hearing Brief at 28. Although it is true that claim 11 does not include a "switching means" element, that is because claim 11 is drawn to a "subscriber station * * **, the subscriber station comprising," while claim 9 is drawn to a "base station * * *, the base station comprising." The subscriber station does not have a PBX 15, and does not have a switching matrix 25. Claim 11, like claim 9, recites in its preamble that the subscriber station and the base station are:

> capable of simultaneous wireless transmission of forward information and reverse information over a radio frequency (RF) link between the telephone lines and the subscriber station on forward and reverse frequency channels, the forward information from the telephone lines being applied to a transmitter and the transmitter transmitting forward signals over the RF link from the base station to the subscriber station, and a receiver receiving reverse signals from the subscriber station over the RF link and the reverse information being applied to the telephone lines

Claim 11 does not require a different construction.

Ericsson's additional argument that the next element in claim 9, namely:

> interconnection means placing the forward signals on a time slot of one of said forward frequency channels, whereby said forward signals may be reconstructed at a subscriber station to provide substantially the same information as the forward information provided on a telephone line, the interconnection means re-

ceiving reverse signals over the RF link on the reverse frequency channel from the subscriber stations as reverse signals;

Ericsson's Post-Hearing Brief at 29, requires its proposed construction is likewise misplaced. Ericsson argues that "placing the forward signals" on a time slot means that the "forward signals" must be compressed signals ready to be so placed. Although this element is discussed further below, both parties agree that the "corresponding structure" includes at least CCU 18. The signal at this stage has been compressed. But that does not mean that "forward signals" always equates to a compressed signal. The issue is one of scope.

Certainly patentees are entitled to define their inventions with varying degrees of scope. Patentees do that by selecting words and phrases and by deciding on various limitations used in the claims. In this instance, signals leaving the right-hand side of PBX 15 in Fig. 2 are subjected to various further operations as described at length in the specification and recounted to some degree above. The physical format or structure of those signals change. There is nothing wrong with a patentee choosing to adopt a term or phrase in the claims that describes a signal (or other component or feature) generally without limiting the signal, or component, or structure to any specific format or structure. That, again, is purely a matter of scope. When the patentee does so, an argument that the term or phrase *must* have a narrower meaning because at some stage along the way the signal has this or that specific format or structure, misses the mark. The patentee, in such an instance, chose the term or phrase specifically to avoid being limited to any specific format or structure, or perhaps to cover something that changes format or structure along its path.

That is the situation here. Once it is understood that the phrases "forward signal" and "reverse signal" are used in the claims merely to refer to a signal generally in the forward or reverse direction, it no longer matters whether the actual physical signal along its path has a format A at point X, or a format B at point Y, and so forth. Nothing in the claims themselves or in the specification would justify, much less compel, equating or limiting the terms "forward signal" and "reverse signal" to compressed signals even if at junctures along the signal path the actual physical signal may be compressed.

4. Recommendation

Accordingly, the special master recommends that the Court conclude as follows:

> In the "switching means" element of claim 9 of the '358 patent, the stated function is "for coupling the forward information from the telephone lines as forward signals to the transmitter, and the switching means coupling the reverse signals from the receiver as reverse information to the telephone lines." The "corresponding structure" is switch matrix 25 in PBX 15.

Under the terms of § 112(6), the claims should therefore be construed to cover that corresponding structure and equivalents thereof.

C. "interconnection means"

1. The Claim

As noted above, claim 9 of the '358 patent called for:

> interconnection means placing the forward signals on a time slot of one of said forward frequency channels, whereby said forward signals may be reconstructed at a subscriber station to provide substantially the same information as the forward information provided on a telephone line, the interconnection means receiving reverse signals over the RF link on the reverse frequency channel from the subscriber stations as reverse signals;

Again, both parties agree that this limitation is in means-plus-function format and should be construed under § 112(6). The special master agrees.

2. The Issue in Dispute

Also, once again, the parties differ on what constitutes the "corresponding structure." Ericsson says that this "element is nothing more than a combination of the 'channel control means' and the 'transmitter and receiver means' of the '705 patent (and the '089 Patent as well)." Ericsson's Pre-Hearing Brief at 20. Accordingly, Ericsson contends that the corresponding structure for performing the recited function is CCU 18, PSK modem 19, RFU 21, and antenna interface 22. *Id.* InterDigital says the corresponding structure is CCU 18. InterDigital's Post-Hearing Brief at 20.[30]

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[30] In this instance, the specification of the '358 patent offers little assistance. Although the specification, as amended at some stage, refers to "interconnection means," the language is virtually the same as the claim – or vice versa:

> The interconnection means at the base station place the forward signals on a time slot of one of the forward frequency channels whereby the forward signals may be reconstructed at a subscriber station to provide substantially the same information as the forward information provided on a telephone line. The interconnection means receives reverse signals over the RF link on the reverse frequency channel from the subscriber stations as reverse signals.

('358 patent, Col. 1, line 67-Col. 2, line 6)

3. The Parties' Proposed Constructions

The parties' positions are set out in their respective proposed orders:[31]

InterDigital's Proposed Construction	Ericsson's Proposed Construction
The base station system includes an interconnection mechanism that places the forward direction signals on a time slot of one of the forward frequency channels. The forward and reverse frequency channels are divided into time slots. The forward direction signals may be reconstructed at the subscriber station to provide substantially the same information as the forward information provided on a telephone line. The interconnection mechanism also receives reverse direction signals from the subscriber station over the radio frequency (RF) link on a reverse frequency channel. The recited function is placing the forward signals in time slots of a forward frequency channel so that the forward information signals may be reconstructed at a subscriber station to provide substantially the same information provided on the telephone lines and receiving reverse signals from time slots of a reverse frequency channel. The corresponding structure is CCU 18 and equivalents thereof.	The recited function of this "means-plus-function" element is placing the forward compressed digital signals output from the switching means on a time slot of one of the forward frequency channels, whereby the placed forward signals may be reconstructed at a subscriber station to provide substantially the same analog voice information as provided on an analog telephone line; and receiving compressed digital signals over the RF link on the reverse frequency channel from subscriber stations as reverse signals. The disclosed structure is a channel control unit CCU that interconnects each codec of the switching means to a particular time slot, a PSK modem, an RFU and an antenna interface, which form a fixed path through the base station from a codec to a time slot of a forward frequency channel, for the duration of a call. As a matter of law, the claim element cannot encompass structure using GMSK modulation.

4. Discussion

The starting point is to define the claimed function. Here the element is missing the customary "for" following the word "means" (both occurrences), but it is nonetheless evident that the claimed function of the "interconnection means" is two-fold, namely (1) for "placing the forward signals on a time slot of one of said forward frequency channels," and (2) for "receiving reverse signals over the RF link on the reverse frequency channel from the subscriber stations as reverse signals." What about the "whereby" clause? "Whereby" clauses have received varying interpretations

[31] Dr. Cox relied, in part, on the term "reconstructed" in the "whereby" clause in this element in giving his opinion that the "switching means" element included a compression function. Ericsson, in its Post-Hearing Brief at 30, states "[t]o dispel any confusion, Ericsson does not contend that compression is part of the structure of the interconnection means element." The remainder of the claim language of this element that Ericsson says supports its position *visà-vis* the "switching means" element is addressed above in conjunction with that element.

depending upon the actual words and context of the claims in which they appear. In this instance, the "whereby" clause further characterizes the function of "placing" by adding the qualification that the "placing" is such that "said forward signals may be reconstructed at a subscriber station to provide substantially the same information as the forward information provided on a telephone line."

Whether that "whereby" clause is properly characterized as being part of the claimed function or not makes no difference here. Ericsson says that it "is the CCU 18 that places the compressed digital signals output from the multiple codecs 16 on time slots to form a transmit channel bit stream." Ericsson's Pre-Hearing Brief at 20. Ericsson is correct. The specification explains that "[e]ach CCU 18 controls the TDMA function and also functions as a link-level protocol processor. Each CCU 18 takes the transmit channel outputs of codecs 16 in the corresponding VCU 17 and transmits the data in the proper time slot and in the proper format to a modem unit 19." ('358 patent, Col. 9, lines 53-58) Although Ericsson goes on to add that modem 19, RFU 21, and antenna interface 22 because those structures participate in the actual transmission, *id*, that is beyond the scope of the first recited function.

Claim 1 of the '705 patent called for:

> transmitter and receiver means both at said base station and at said subscriber stations for providing direct communication between said base station and said subscriber stations over the said radio frequency (RF) channels;

and the claimed function was "for providing direct communication between said base station and said subscriber stations over the said radio frequency (RF) channels." Here, in contrast, the claimed function of the "interconnection means" is (1) for "placing the forward signals on a time slot of one of said forward frequency channels," and (2) for "receiving reverse signals over the RF link on the reverse frequency channel from the subscriber stations as reverse signals." Transmitting is not part of the first recited function. That first function, as Ericsson admits and as confirmed by the specification, is performed by CCU 18. Even if the "whereby" clause is considered part of the claimed "function," CCU 18 is also responsible for performing the function of "placing" in such a manner that "said forward signals may be reconstructed at a subscriber station to provide substantially the same information as the forward information provided on a telephone line."

So far, only the first recited function has been addressed. The second recited function is "receiving reverse signals over the RF link on the reverse frequency channel from the subscriber

stations as reverse signals." "Transmitting" was not part of the first recited function, but "receiving" is clearly part of the second recited function. Additionally, the claim calls for "receiving * * * over the RF link" The CCU alone does not perform that function. That function requires, in addition, a modem 19 (but not necessarily a PSK modem), an RFU 21 and an antenna interface.

5. Recommendation

Accordingly, the special master recommends that the Court conclude as follows:

> In the "interconnection means" element of claim 9 of the '358 patent, the stated functions are (1) for "placing the forward signals on a time slot of one of said forward frequency channels," and (2) for "receiving reverse signals over the RF link on the reverse frequency channel from the subscriber stations as reverse signals." The "whereby" clause further characterizes the function of "placing" by adding the qualification that the "placing" is such that "said forward signals may be reconstructed at a subscriber station to provide substantially the same information as the forward information provided on a telephone line." The "corresponding structure" required to perform both of those functions is CCU 18, a modem 19 (but not necessarily a PSK modem), an RFU 21 and an antenna interface.

Under the terms of § 112(6), the claims should therefore be construed to cover that corresponding structure and equivalents thereof.

D. "means to provide a periodic exchange"

1. The Claim Element

The parties' disagreement concerns the "means to provide a periodic exchange" clause – the last clause – of claim 9 of the '358 patent which calls for:

> means to provide a periodic exchange of information during the course of communication operation concerning the present status of the connection between the base station and a subscriber station, the link quality, power, and timing adjustment thereof and providing adjustment to the subscriber station based thereupon.

Repeating the now familiar refrain, the parties agree that this clause is drafted in means-plus-function format governed by § 112(6), and the special master agrees. And, once again, the parties' positions require one to ferret out the "corresponding structure."

2. The Parties' Proposed Constructions

The parties' positions, as reflected in their respective proposed orders, are:

InterDigital's Proposed Construction	Ericsson's Proposed Construction
The base station system includes a mechanism with the capability to provide a periodic exchange of information during the course of communication. Here, this exchange of information occurs more than once during the course of an established communication. The information exchanged in this manner includes: (a) the present status of an existing connection between the base station and a subscriber station. (b) the link quality; (c) the signal power; and (d) timing adjustment of the connection Adjustment to the subscriber station is provided based upon any of the information exchanged. The recited function is to provide a periodic exchange of information during the course of communications and adjustment to the subscriber station based thereupon. The information exchange may concern the present status of the connection, the link quality, power, and timing adjustments. The corresponding structure is CCU 18 and RPU 20 in the base station and equivalents thereof.	The recited function of this "means-plus-function" element is providing a periodic exchange of information between the base station and a subscriber station indicating the present status of the connection between the base station and the subscriber station, the link quality, the power adjustment, and the timing adjustment; and providing adjustment to the subscriber station based upon the periodic exchange of information concerning the present status of the connection between the base station and the subscriber station, the link quality, the power adjustment and the timing adjustment. The phrase "periodic exchange" requires that the code be exchanged between the single base station and a subscriber station and be exchanged between a subscriber station and the single base station. This necessarily requires that there be a bi-directional exchange of information. The term periodic is defined, in the context of the patent, as occurring in every time slot of very TDMA frame. The disclosed structure is a CCU, RPU, RFU, PSK modem and antenna interface at the base station and a CCU, STU, RFU and PSK modem at the subscriber station. Each CCU includes a microcontroller and associated software which generates a bi-directionally exchanged 12-bit code word within every time slot of the bit stream and extracts the present status of the connection between the base station and the subscriber station, the link quality, the power adjustment and the timing adjustment from the code; the CCU, STU, RFU and PSK modem at the subscriber station are configured to use the

InterDigital's Proposed Construction	Ericsson's Proposed Construction
	present status of the connection between the base station and the subscriber station, the link quality, the power adjustment and the timing adjustment from the code for performing respective adjustments to the subscriber station. As a matter of law, the code word must be used to exchange all of those four types of information between the base station and the subscriber stations in every time slot of every TDMA frame.

3. Discussion

The recited function in the claim element is twofold, namely (1) "to provide a periodic exchange of information during the course of communication operation concerning the present status of the connection between the base station and a subscriber station, the link quality, power, and timing adjustment thereof," and (2) "providing adjustment to the subscriber station based thereupon."

As discussed above in conjunction with the "means to determine synchronization" element of the '705 patent, the specification explains that the 12-bit code word is used to determine synchronization and are used to exchange the current state of the connection:

> Next, a twelve bit code word is used to determine synchronization between the subscriber and base station and to exchange control and status information. Code words are used to exchange the current state of the connection, link quality and power and timing adjustments. Each control word is encoded into ten bits using a Hamming code, which allows single error correction and double error detection. The CCU 18 determines the gain and loss of synchronization by tracking the number of consecutive code words received correctly or incorrectly; and the CCU 18 passes synchronization changes to the RPU 20 in the base station. In the subscriber station, the CCU 29 passes synchronization changes to the STU 27. [Emphasis added.]

('358 patent, Col. 21, lines 35-47) Once again, one of the recited functions in the claim is "to provide a periodic exchange of information during the course of communication operation concerning the present status of the connection between the base station and a subscriber station, the link quality, power, and timing adjustment thereof." The specification plainly explains that function is per-

formed by "a twelve bit code word." The "structure" described in the specification for performing the stated function is the "twelve bit code word."

The second stated function is "providing adjustment to the subscriber station based thereupon." Basically the parties disagree on whether that functional statement requires actual adjustment. InterDigital emphasizes that the claim requires providing adjustment "to" the subscriber station, while Ericsson emphasizes that the claim requires providing "adjustment." InterDigital's Post-Hearing Brief at 21, Ericsson's Post-Hearing Brief at 31. InterDigital accordingly says that the "corresponding structure is CCU 18 and RPU 20 in the base station and equivalents thereof." Ericsson says that the "disclosed structure is a CCU, RPU, RFU, PSK modem and antenna interface at the base station and a CCU, STU, RFU and PSK modem at the subscriber station."

The clause itself admits of both constructions. The specification explains, as quoted above, that "the CCU 18 passes synchronization changes to the RPU 20" in the base station, and that in the subscriber station, "the CCU 29 passes synchronization changes to the STU 27." Elsewhere the specification says that the "subscriber station VCU and CCU function in essentially identical manner as in the base station." ('358 patent, Col. 11, lines 6-8). Thus, equipment at the subscriber stations actually performs the "adjustment," but an adjustment is made on the basis of data supplied "to" the subscriber stations by the base station.

The brick (or feather) that likely shifts the balance is InterDigital's correct observation that claim 9 is drawn to a "base station system." Indeed, claim 9 calls for "the base station system comprising" wherein this is one of the listed elements. It is true that "system" arguably encompasses more than the "base station," but the general content of the claim suggests that it was intended to be focused on the base station, rather than the "system." In that regard, it is noted that claim 1 of the '358 patent is directed to the "system," and claim 2 appears to be drawn to a system method paralleling claim 1. Other claims such as claim 11 focus on the subscriber stations.

The issue is not entirely free from doubt, and plausible arguments can be, and have been, advanced on both sides. But given the general content of claim 9 and its context in the '358 patent, it is more reasonable than not to conclude that the intent was to direct claim 9 to the base station. As also discussed above in conjunction with the "means to determine synchronization" element of the '705 patent, the specification also explains that the "CCU 18 controls the TDMA functions and

also functions as a link-level processor. * * * Each CCU 18 determines the modulation levels, as directed by a remote-control processor unit RPU 20, to be used for the broadcast (such as 2, 4 or 16 level PSK modulation). Each CCU 18 also processes control information for communication to the subscriber stations through the radio channel (RCC) time slot and during overhead control bits in the voice channels." ('358 patent, Col. 9, lines 54-65)

There is also Dr. Levesque's testimony above:

> Q. How does the structure that you have just described use code words?
>
> A. Well, there's a process of transmitting code words and then checking for validity using an error detection routine on the receive end. The code word is searched for -- that's not a good phrase. There's a search for the code word in a designated position. And if no code word is detected for five consecutive frames, then the channel is declared to be out of sync. And then it is up to the RPU to take whatever appropriate action would follow and out of sync condition. [Emphasis added.]

Transcript at 193.

Accordingly, InterDigital is correct that the "corresponding structure" disclosed in the specification for performing the claimed function includes CCU 18 and RPU 20 in the base station. That "corresponding structure," however, also includes the "twelve bit code word" discussed above. InterDigital's argument that "unlike the '705 patent, the plain language of the '358 claim 9 does not even recite a 'code,'" InterDigital's Post-Hearing Brief at 22, is beside the point. The 12-bit code word is disclosed as at least part of the "corresponding structure." The fact that InterDigital chose to use a means-plus-function claim element knowing that it would be construed under § 112(6) is sufficient to sweep the 12-bit code word into construction of the claim regardless of whether "code" appears in the language of the claim.

Ericsson's proposed construction adds that "each CCU" includes "a microcontroller and associated software." As discussed above, it is a true statement that the specification so describes the CCUs. Fig. 21 and the accompanying disclosure illustrate and explain that the CCUs have a "microcontroller module" 111 and that the "software executes on an Intel 8031 microcontroller 111." ('358 patent, Col. 55, lines 59-60) As further discussed above, the disclosed software controlling the operation of the CCUs is part of the "corresponding structure," but, there is no reason to add to the construction of this claim element Ericsson's description of what the software does, namely that

the "associated software * * * generates a bidirectionally exchanged 12-bit code word * * *." On that issue, the comments above in conjunction with the "means to determine synchronization" element of the '705 patent are applicable here as well.

4. Recommendation

Accordingly, the special master recommends that the Court conclude as follows:

> In the "means to provide a periodic exchange" element of claim 9 of the '358 patent, the stated functions are (1) "to provide a periodic exchange of information during the course of communication operation concerning the present status of the connection between the base station and a subscriber station, the link quality, power, and timing adjustment thereof," and (2) providing adjustment to the subscriber station based thereupon. The "corresponding structure" disclosed in the specification for performing the claimed functions consists of CCU 18, RPU 20, a 12-bit code word, and related software for performing that claimed functions.[32]

---

[32] As discussed earlier, InterDigital has filed comments to the draft report and recommendation urging that "12-bit" be deleted in describing the "corresponding structure" for the "means to determine synchronization" element in the '705 patent. Those comments urge a similar modification to the construction of the "means to provide a periodic exchange" elements of claims 9 and 11 of the '358 patent, *i.e.*, that the corresponding structure be described as simply a "code word" rather than a "12-bit code word." InterDigital's Comments at 7 *et seq.* In addition to the earlier arguments, InterDigital urges that unlike claim 1 of the '705 patent, claim 9 does not include the function "to determine synchronization" or the element of "utilizing a code." *Id.* at 8. That, of course, is correct. But claim 9 calls for a "means to provide a periodic exchange of information," and, as InterDigital acknowledges, the specification states that "a twelve bit code word is used to determine synchronization * * * and to exchange control and status information." *Id.* The next succeeding reference to "code words" being used to exchange the current state of the connection, link quality et cetera, in context, is clearly a reference to the "twelve bid code word." Although, as discussed above, the specification also refers to a "ten-bit code" in the description of the "Hamming code" and uses the phrase "code word" several times in other contexts, the fact remains that the specification plainly explains that a 12-bit code word is used to perform the claimed function.

Further, in answer to InterDigital's argument that there "is no suggestion that a particular number of bits, let alone 12 bits, are required to perform the recited function," *Id.*, indeed the specification may be fairly interpreted as saying precisely that – the sole and only disclosure is that a 12-bit code word performs (or rather is part of the "structure" that is disclosed as performing) the recited function. In drafting the specification, InterDigital or its predecessor could have explained, if it were true, that a code word of any number of bits could be used. But InterDigital did not do so. Indeed, on the current record, it cannot be said with any confidence that a code word of any number of digits could, in fact, be used, *i.e.*, that the claimed function could be performed equally well if at all with, for example, a 1-bit code word.

The Court is necessarily constrained by the specification as drafted, including those areas where the specification is silent. Here the specification does not provide any description for using other than a 12-bit code word. One does not know from the specification if, in fact, code words of different lengths could be used, or if, perhaps, there was a minimum number of bits or a necessary range of bits that could be used. Moreover, the testimony at the *Markman* hearing did not establish otherwise. Dr. Levesque's testimony regarding how the system searched for a "code word," Tr. at 193, which InterDigital points to, *Id.* at 6, offers no assistance on the matter. Under the circumstances, there is simply no choice but to construe the claims under § 112(6) in light of the specification as InterDigital or its predecessor drafted it. Doing so may at times work an injustice and result in a claim construction that is narrower than the technology deserves. Perhaps that is the case here. But the time for addressing such concerns is during prosecution before the PTO.

Under the terms of § 112(6), the claims should therefore be construed to cover that corresponding structure and equivalents thereof.

E. "set-up means"

1. The Claim Element

The focus now shifts to claim 11 of the '358 patent, but the landscape remains familiar. Claim 11 shares some of the same disputed terms, *e.g.*, "toll quality," that appear in claim 9 and which have been discussed above. Accordingly, the foregoing discussion of such terms applies to claim 11 as well.

The specific claim element now in dispute is the "set-up means" element, namely:

> 11. A subscriber station * * *, the subscriber station comprising:
>
> set-up means placing the reverse signals on a time slot of one of said reverse frequency channels, whereby said reverse signals may be reconstructed at the base station to provide substantially the same information as the reverse information provided from a user, the set-up means receiving forward signals over the RF link on the forward frequency channel from the base station as forward signals;

Repeating the now likely numbing and hopefully self-evident observation, the parties agree that this clause is drafted in means-plus-function format governed by § 112(6), and the special master agrees. And too, the ferret emerges once more as the animal of choice to burrow in search of – could there be any doubt – the "corresponding structure."

2. The Parties' Proposed Constructions

The parties' positions, as reflected in their respective proposed orders, are by now no doubt engraved perpetually on the psyche, but are nevertheless reproduced here for sake of completeness and to thwart any charge that they may have been overlooked:

InterDigital's Proposed Construction	Ericsson's Proposed Construction
The forward and reverse frequency channels are divided into time slots. The subscriber station includes a set-up mechanism that places the reverse direction signals on a time slot of one of the reverse direction frequency channels.	The recited function of this "means-plus-function" element is placing analog voice information that may be reconstructed at the base station to provide substantially the same analog voice information as provided by the user onto a time slot as compressed digital signals to be ap-

InterDigital's Proposed Construction	Ericsson's Proposed Construction
The reverse direction signals may be reconstructed at the base station to provide substantially the same information as that provided from a user. The set-up mechanism also receives forward direction signals from the base station over the radio frequency (RF) link on a forward frequency channel. The recited function is placing reverse signals (to be transmitted to a base station) into time slots of a reverse frequency channel, and receiving forward signals transmitted over an RF link by the radio base station on a forward frequency channel. The set-up means enables reconstruction of the signal received at the base station to provide substantially the same information as provided by a subscriber station user. The corresponding structure is CCU 29 in the subscriber station and equivalents thereof.	plied to a reverse frequency channel, and receiving compressed digital voice signals from the base station over the RF link on the forward frequency channel. The recited function requires Aconverting@ and Acompressing@ as in Claim 1 of the >705 Patent. The disclosed structure is an STU including an A/D converter and a D/A converter for converting the analog voice information to/from 64 kbps μ–law companded PCM digital samples, a VCU, a CCU that interconnects to a timeslot, a PSK modem, an RFU, and an antenna interface. The disclosed VCU includes a codec that implements either a RELP or SBC compression algorithm on the linear PCM digital samples. The codec necessarily changes 64 kbps μ–law companded PCM digital samples to linear PCM digital samples prior to implementing either a RELP or SBC compression algorithm. As a matter of law, the claim element cannot encompass structure using GMSK modulation and cannot encompass structure implementing a VSELP or RPE/LTP compression algorithm.

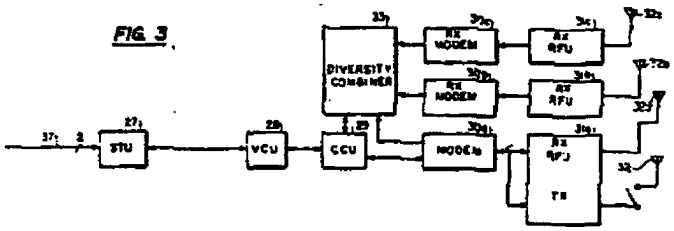
3. Discussion

The issues here are essentially the same as those discussed above in conjunction with the "switching means" and "interconnection means" elements of claim 9 of the '358 patent. Ericsson contends that the element inherently or implicitly requires converting and compressing relying once again on its "information" versus "signals," and its "placing" arguments. Those arguments are addressed fully above, and those comments apply here as well. In short, Ericsson's argument is not persuasive.

The functions recited in the subject claim element, like the "interconnection means" claim element of claim 9, are two: (1) "placing the reverse signals on a time slot of one of said reverse frequency channels," and (2) "receiving forward signals over the RF link on the forward frequency channel from the base station as forward signals." Also similar to the "interconnection means" ele-

ment, there is a "whereby" clause that further defines the "placing" function, namely "whereby said reverse signals may be reconstructed at the base station to provide substantially the same information as the reverse information provided from a user." Here, as well, it is debatable whether the "whereby" clause is more accurately characterized as actually being part of the stated function, or whether it operates as a limitation on the stated function. In a larger academic sense, there may or may not be any difference between the two; after all, if a clause operates as a limitation on a functional statement, there is some logic in construing that limitation as *part* of the functional statement. But, any such difference, if there is a difference, is not material here.

Fig. 3, a block diagram of a subscriber station:



is described as having a "functional partitioning" similar to that of the base station. In the subscriber station, the "user interface function is performed by the subscriber telephone interface unit (STU) in the subscriber station," while the "associated function in the base station is performed by the PBX module." The specification also stated that the "STU in the subscriber station also performs all control functions of the subscriber station just as the RPU functions in the base station." ('358 patent, Col. 10, lines 39-46) The specification further explains that "the user voice or data information is first processed by a subscriber terminal unit (STU) 27. The voice signal inputs from the user telephone are received and digitized in the VCU 28. The format for the digitized voice signals is identical to the format used by the PBX 15 in the base station." (Col. 10, lines 53-57)

As discussed above in conjunction with the "interconnection means" element of claim 9, the specification does not define or equate "forward signals" with compressed digital signals, and likewise does not define or equate "reverse signals" with compressed signals. Both phrases were apparently introduced during the prosecution of the '358 patent or one of its intermediate parent applications. Neither phrase appears in the specifications for the '863, '089 or '705 patents.

In portions of the specifications common to all of the Paneth patents, however, the written description explains that in assigning channels, one channel is assigned to the base station for transmission, *i.e.*, "the forward frequency," and another channel, *i.e.*, "the reverse frequency," is assigned to the subscriber stations for transmission. The specification common to all of the patents explains that "the base station transmits on the forward frequency and receives on the reverse frequency. The opposite is true for the subscriber station." ('089 patent, Col. 12, lines 2-10)

As explained above, the terms "forward signals" and "reverse signals" use the same "forward" and "reverse" convention, and, in context, are merely generic references to signals in a forward or reverse direction rather than references to any specific signal.

With respect to the term "information," it was explained above in reference to claim 9 that, in the context of the specification and drawings, "information" refers to inflow and outflow on the left side of PBX 15 in Fig. 2, as Dr. Levesque testified. Transcript at 206-07. The term "signals," Dr. Levesque testified, refers to the outflow and inflow on the right-hand side of PBX 15 in Fig. 2. Transcript at 206-207. Ericsson argues that like terms even in different claims should be construed in the same fashion, citing *Georgia-Pacific Corp. v. United States Gypsum Co.*, 195 F.3d 1322, 1331 (Fed. Cir. 1999), and because claim 11 does not include a switch, Dr. Levesque's explanation of "information" and "signals" just does not hold water.

But Dr. Levesque's testimony is not so leaky. Claim 11 does not include a "switching means" element because claim 11 is drawn to a "subscriber station" rather than the "base station" that is the subject of claim 9. The subscriber station does not have a PBX 15, and does not have a switching matrix 25. Claim 11 thus cannot claim what it does not have. Nevertheless, the subscriber station has components that mirror the functions performed by components in the base station.

Once again, the specification explains that in the subscriber station, the user interface function is performed by the subscriber telephone interface unit (STU) which mirrors functions performed in the base station by the PBX module. The specification also discloses that the STU performs all control functions of the subscriber station just as the RPU functions in the base station. ('358 patent, Col. 10, lines 39-46) The specification additionally explains that "the user voice or data information is first processed by a subscriber terminal unit (STU) 27. The voice signal inputs from

the user telephone are received and digitized in the VCU 28. The format for the digitized voice signals is identical to the format used by the PBX 15 in the base station."

It thus appears to be reasonably clear that "information" *vis-à-vis* the subscriber station is the same "information" as in the base station. The physical electronic nature, and physical location, may be different, but in both cases "information" refers to inflows and outflows from the system. In Fig. 3, "information" refers to the inflows and outflows from the left-hand side of STU 27. "Signals" refers to the inflows and outflows on the right-hand side of STU 27. As in the case of "signals" in Fig. 2, "signals" leaving the right-hand side of STU 27 are subjected to further processing as described at length in the specification. The physical format or structure of the "signals" may change along their path, but as explained above, there is nothing wrong with a patentee choosing to adopt a term or phrase in the claims that describes a signal (or other component or feature) generally without limiting the signal, or component, or structure to any specific format or structure. That is purely a matter of scope. The patentee is entitled to chose a term or phrase specifically to avoid being limited to any specific format or structure. As discussed above in conjunction with claim 9, the phrases "forward signal" and "reverse signal" are used in the claims merely to refer to a signal generally in the forward or reverse direction. Nothing in the claims themselves or in the specification justify or compel equating or limiting the terms "forward signal" and "reverse signal" to compressed signals even if at junctures along the signal path the actual physical signal may be compressed.

The first recited function in the claim element, namely "placing the reverse signals on a time slot of one of said reverse frequency channels," is performed by CCU 29.[33] Although the STU and VCU perform certain operations on those signals before reaching the CCU, it is the CCU that actually performs the step of "placing."

The second recited function, namely "receiving forward signals over the RF link on the forward frequency channel from the base station as forward signals," presents a different issue, similar to that presented by the second recited function in the "interconnection means" of claim 9. Here, the stated function includes not only "receiving," but specifically "receiving * * * over the RF link."

[33] The specification explains that the "channel controller unit (CCU) performs similar functions in both the subscriber stations and the base station. The hardware used in the two stations types for the CCU function is, in fact, identical." ('358 patent, Col. 51, lines 35-38)

CCU 29 alone does not perform that function. That function additionally requires a modem (but not necessarily a PSK modem), and an RFU. As shown in Fig. 3 above, the modems are elements 30a-30c, and the RFUs are elements 31a-31c. Additionally, although not shown in Fig. 3, that function requires an antenna interface which is illustrated in Fig. 28, said to represent "a block diagram of the antenna interface circuit for the subscriber station of FIG. 3." ('358 patent, Col. 6, lines 32-33) The specification explains that:

> The RFU subsystem provides the communications channel link between the modem and the antenna in both the base station and the subscriber station. The RFU functions as a linear amplitude and frequency translator and is essentially transparent to the channel data and modulation characteristics.
>
> The antenna interface circuit for the subscriber station is shown in FIG. 28. A RFU control logic circuit 192 is coupled to the transmitter antenna 32, and the three receiver antennas 32a, 32b and 32c by the antenna interface circuit. The RFU control logic circuit 192 is also interfaced with the transmit section of the modem 30a, and the receive sections of the modems 30a, 30b and 30c. * * *
>
> * * * A first receiver section RX 1 of the antenna interface includes a down converter and amplifier 198, a RX synthesizer 199 and a preamplifier 200 which is connected to switch 197. * * *
>
> * * * * *
>
> The RFU control logic circuit 192 provides the following signals to each of the receiver sections of the antenna interface circuit in response to the signals received from the respective receive sections of the modems 30a, 30b and 30c: (1) a TX enable signal on lines 213 to cause the down converter and amplifier circuits 198, 202 to operate in the receive modes; (2) an automatic gain control (AGC) signal on lines 214 to the down converter and amplifier circuits 198, 202; (3) a clock reference signal on lines 215 to the RX synthesizers 199, 203; and (4) a channel select signal on lines 216 also to the RX synthesizers 199, 203 respond to the channel select signal on lines 216 by providing a RX frequency select signal on lines 217 to the down converter and amplifier circuits 198, 202 that is equal to the difference between the desired receive frequency and the modem IF frequency. The down converter and amplifier circuits 198, 202 provide IF output signals on line 218 to the RFU control logic circuit 192 for delivery to the receive sections of the respective modems 30a, 30b and 30c.

('358 patent, Col. 70, line 14-Col. 71, line 5)

4. Recommendation

Accordingly, the special master recommends that the Court conclude as follows:

> In the "set-up means" element of claim 11 of the '358 patent, the stated functions are (1) placing the reverse signals on a time slot of one of said reverse frequency channels, and (2) receiving forward signals over the RF link on the forward frequency channel from the base station as forward signals." The "whereby" clause further characterizes the function of "placing" by adding the qualification that the "placing" is such that "said reverse signals may be reconstructed at the base station to provide substantially the same information as the reverse information provided from a user." The "corresponding structure" required to perform both of those functions is CCU 29, a modem (but not necessarily a PSK modem), an RFU, and an antenna interface.

Under the terms of § 112(6), the claims should therefore be construed to cover that corresponding structure and equivalents thereof.

F. "means to provide a periodic exchange"

1. The Claim Element

Claim 11 of the '358 patent calls for the following "means to provide a periodic exchange" element:

> means to provide a periodic exchange of information during the course of communication operation concerning the present status of the connection between the base station and a subscriber station, the link quality, power, and timing adjustment thereof and providing adjustment to the subscriber station based thereupon.

that is identical to that found in claim 9, and discussed above. The parties' arguments essentially parallel those made in reference to claim 9. Thus, the above comments *vis-à-vis* claim 9 are applicable here as well. As noted above, however, claim 9 is directed to the base station, and claim 11 is directed to a subscriber station. The specification explains that:

> The CCU 18 determines the gain and loss of synchronization by tracking the number of consecutive code words received correctly or incorrectly; and the CCU 18 passes synchronization changes to the RPU 20 in the base station. In the subscriber station, the CCU 29 passes synchronization changes to the STU 27. [Emphasis added.]

('358 patent, Col. 21, lines 42-47) Thus, on the same rationale, here the "corresponding structure" is that found in the description for the subscriber station.

2. Recommendation

Accordingly, the special master recommends that the Court conclude as follows:

> In the "means to provide a periodic exchange" element of claim 11 of the '358 patent, the stated functions are (1) "to provide a periodic exchange of information during the course of communication operation concerning the present status of the connection between the base station and a subscriber station, the link quality, power, and timing adjustment thereof," and (2) providing adjustment to the subscriber station based thereupon. The "corresponding structure" disclosed in the specification for performing the claimed functions consists of CCU 29, STU 27, a 12-bit code word, and related software for performing that claimed functions.

Under the terms of § 112(6), the claims should therefore be construed to cover that corresponding structure and equivalents thereof. What is equivalent here

VII.
The '194 Patent

A. Claim 1

1. "assigning pathing"

Claim 1 of the '194 patent is a method claim, and provides with emphasis added:

> 1. A method for communication of at least one voice signal, comprising the steps of:
>
> (1) assigning pathing for processing the information signal to be transmitted over an RF link to a receive unit;
>
> (2) capturing in a predetermined manner the information signal being processed according to pathing assigned at substep (1) to produce signal samples representative of the information signal;
>
> (3) compressing the signal samples by block encoding or waveform encoding such that the signal samples may be reconstructed at the receive unit to substantially provide the same information as the information signal provided before being processed according to the step (1) wherein the signal sample compression is performed at a given preselected rate;
>
> (4) placing the compressed signal samples representative of the information signal in predetermined, discrete positions of each repeating segment of transmit signal channel; and

> (5) transmitting over an RF link to the receive unit the portion of each segment of the transmit signal channel containing the compressed signal samples representative of the information signal.

The dispute here centers on the "assigning pathing" element.

a) The Parties' Proposed Constructions

The parties' proposed constructions are:

InterDigital's Proposed Construction	Ericsson's Proposed Construction
(1) The signal to be sent is assigned to a processing path. The signal is to be sent over a radio frequency (RF) link to a receiver unit.	This element requires assigning of a fixed communication path through the base station for the duration of each call to perform the other steps of the claim.

Ericsson's actual contention, however, is a bit different. Ericsson asserts that "assigning pathing" means assigning a call to a hardware-mapped signal path. Ericsson's Post-Hearing Brief at 34. That, in Ericsson's view, has two consequences, namely (1) the slot/frequency assignment is for an entire path, and (2) the path is assigned for the entire duration of a call. *Id.* at 34-35.

b) Discussion

First, Dr. Levesque, proffered by InterDigital, testified that "assigning pathing" would not have been generally understood in the art:

> Q. Moving on to the assigning pathing feature of Claim 1. Is the phrase "assigning pathing" -- or would it have been commonly understood by one skilled in the art in March of '85?
>
> A. I don't think so. It is a stand-alone phrase by itself. I don't think that could have been readily interpreted at that time.

Transcript at 225. Dr. Cox, proffered by Ericsson, agreed:

> Q. Let's go to Slide 51, please. We're now turning to the '194 patent, which is Joint Exhibit 4. And I have on the screen the first step of Claim 1. The assigning pathing step. Do you agree or disagree with Dr. Levesque the term of "assigning pathing" was not a term of art in 1985?
>
> A. I don't recall what Dr. Levesque said about it, but I never saw the term "assigning pathing" before I saw these patents. This is not a term that I'm familiar

> with, and I don't believe it's a term of art that would be understood by people in the business.

Transcript at 620.

In order to discern a meaning, Dr. Cox resorted to the specification which says that the "circuits of each VCU 17 are hardware-mapped such that a voice call on a specific frequency and slot assignment in the base station is always processed by the same VCU codec 16." ('194 patent, Col. 8, lines 26-29) Dr. Cox testified that indicated to him that the "voice call is always connected to the same structure for the duration of that call:"

> Q. Let's go to Slide 52. This is from the '194 patent spec, Column 8, lines 26 to 29. Does that relate to your opinion?
>
> A. Yes. This is describing how a voice call gets hardware mapped to a specific frequency and slot assignment in the base station and that a voice call is always processed by the same codec which implies -- always implies that that voice call is always connected to the same structure for the duration of that call..

Id. Ericsson asserts that the term "hardware-mapped" thus means that "there is a fixed circuit path between a codec and a frequency/slot position such that the assignment of a codec to a call is also an assignment of a frequency/slot position, and vice versa." [Emphasis in original.] Ericsson's Post-Hearing Brief at 34.

Ericsson also points to the prosecution history of the '358 patent[34] and specifically an amendment and Rule 132[35] declaration, Ericsson Ex. 208, that was filed in response to an Office action dated April 2, 1996. Ericsson's Post-Hearing Brief at 34. The amendment states that "[s]ubmitted herewith is a Rule 132 Declaration by Professor Hermann J. Helgert rebutting the Examiner's obviousness rejection." In paragraph 19 of that declaration, Prof. Helgert avers:

> 19. In the present invention, the slot/frequency assignment is one that assigns an entire path. It does not simply assign a slot to a multiplexer. Thus, the particular Codec that is utilized is based upon the slot/frequency that is assigned.

---

[34] The applications for the '358 and '194 patents were filed on the same day, April 22, 1993, and claimed domestic priority to the same parent application, *i.e.*, application Serial No. 831,198. The application for the '358 patent states that it is a continuation of the parent application. The application for the '194 patent states that it is a division of the parent application.

[35] 37 C.F.R. § 1.132 (Rule 132) provides, in part: "When any claim * * * is rejected * * *affidavits or declarations traversing these references or objections may be received."

In remarks submitted in the amendment, InterDigital argues that:

> Additionally, it is not only the frequency and slot that are assigned. In the present invention, it is the entire path through the base station that is assigned. Thus, the memory selects a particular slot/frequency on a dynamic basis and assigns that to a particular path unit including the Codec, the multiplexer, the modulator, etc. * * * [In Kinoshita, the reference] [t]here is absolutely no assignment of Codecs along with the slot/frequency assignment of that entire path. * * * In the present invention, the assignment takes place such that the Codec itself forms part of the path and the Codec itself is assigned a particular slot/frequency once an assignment is made by the memory.
>
> * * * it was an innovative approach to provide the entire pathing arrangement from the beginning of the Codec all the way through to the end based upon a particular slot/frequency assignment. That feature is clearly not shown [in the reference] and it is impossible to take "official notice" of such feature.

Amendment at 18-19.

Although InterDigital argues generally that "[n]either the claim language nor the specification imposes Ericsson's 'duration of a call' and 'fixed path' limitations," InterDigital's Post-Hearing Brief at 24, the remarks and accompanying affidavit referenced above regarding the fixed path are difficult to avoid, and InterDigital does not exert much effort to do so. InterDigital does, however, point out that the Rule 132 declaration was directed to assignment of a fixed path and did not say anything, at least directly, about the duration of a call. InterDigital notes that the '450 patent provides a means to automatically change either the frequency or time slot configurations, or both, during operation. InterDigital's Post-Hearing Brief at 24 n. 28.

Ericsson responds that the specification discloses that "once an assignment is made, it does not change, unless the call finishes, *i.e.*, the call between the parties ends, or the RF link between base station and subscriber deteriorates to the point that the call can no longer be maintained and is dropped." Ericsson's Post-Hearing Brief at 35. Ericsson also notes that in the Rule 132 declaration, Prof. Helgert concluded *inter alia* that:

> * * * it would not have been obvious to me * * * to [develop?] a mobile terrestrial [sic.] including the following features:
>
> b. The use of a memory maintaining a list of available slot/frequencies to dynamically assign both frequencies and slots based upon incoming and outgoing call requests whereby the entire pathing through the base station is assigned to the specific selected slot/frequency. [Emphasis added.]

Ericsson Ex. 208, Rule 132 declaration at 9. From Prof. Helgert's reference to "incoming and outgoing call requests," Dr. Cox concludes that the slot/frequency assignment is only done at the initiation of the call:

> Q. Go to Slide 54. I want to direct your attention to the words in this. It's also from the prosecution history, Exhibit 208 at page 9. And what relevance, if any, to your opinion is the phrase incoming and outgoing call requests"?
>
> A. Well, this describes the dynamic assignment frequencies and slots that to me means that any slot or frequency can be assigned to any call coming in. It says that this assignment is made based upon incoming and outgoing call requests. So, this states that the slot assignment and frequency assignment is made when the incoming and outgoing call shows up at the base station, and so it's only done at the initiation of the call.

Transcript at 622.

InterDigital is correct, though, that neither the language of the claim *per se* nor the specification directly address either the "fixed path" or "duration of a call" issues. On the other hand, the specification contains no express description of "assigning pathing,"[36] and expert witnesses for both parties agreed that the term had no generally understood meaning. The specification *does* disclose, as Dr. Cox testified, that the "circuits of each VCU 17 are hardware-mapped such that a voice call on a specific frequency and slot assignment in the base station is always processed by the same VCU codec 16." ('194 patent, Col. 8, lines 26-29) Additionally, the amendment and Rule 132 declaration contain clear statements and representations concerning the invention, and specifically clear statements regarding the "fixed path."

The "duration of the call" issue, however, is a different story. Although Dr. Cox was able to reach a conclusion that the snippet from Prof. Helgert's declaration and the hardware-mapped disclosure in the specification necessarily meant that the path was assigned for the entire duration of the call, both are, at best, thin reeds. Even together, substantive support for that position is mostly lacking.

[36] Dr. Levesque was only able to point to language in the specification that, in his words, "outlines the process in a very summary way." Transcript at 226-27.